4.2. Exercises

(1) $\lim_{x\to 3} \dfrac{x^3 - 13x^2 + 51x - 63}{x^3 - 4x^2 - 3x + 18} = \dfrac{a}{5}$ where $a =$ ______ .

(2) $\lim_{x\to 0} \dfrac{\sqrt{x^2 + 9x + 9} - 3}{x} = \dfrac{a}{2}$ where $a =$ _____ .

(3) $\lim_{x\to 1} \dfrac{x^3 - x^2 + 2x - 2}{x^3 + 3x^2 - 4x} = \dfrac{3}{a}$ where $a =$ _____ .

(4) $\lim_{t\to 0} \dfrac{t}{\sqrt{4 - t} - 2} =$ ______ .

(5) $\lim_{x\to 0} \dfrac{\sqrt{x + 9} - 3}{x} = \dfrac{1}{a}$ where $a =$ _____ .

(6) $\lim_{x\to 2} \dfrac{x^3 - 3x^2 + x + 2}{x^3 - x - 6} = \dfrac{1}{a}$ where $a =$ ______ .

(7) $\lim_{x\to 2} \dfrac{x^3 - x^2 - 8x + 12}{x^3 - 10x^2 + 28x - 24} = -\dfrac{a}{4}$ where $a =$ _____ .

(8) $\lim_{x\to 0} \dfrac{\sqrt{x^2 - x + 4} - 2}{x^2 + 3x} = -\dfrac{1}{a}$ where $a =$ ________ .

(9) $\lim_{x\to 1} \dfrac{x^3 + x^2 - 5x + 3}{x^3 - 4x^2 + 5x - 2} =$ ______ .

(10) $\lim_{x\to 3} \dfrac{x^3 - 4x^2 - 3x + 18}{x^3 - 8x^2 + 21x - 18} =$ _____ .

(11) $\lim_{x\to -1} \dfrac{x^3 - x^2 - 5x - 3}{x^3 + 6x^2 + 9x + 4} = -\dfrac{4}{a}$ where $a =$ _____ .

(12) $\lim_{x\to 0} \dfrac{2x \sin x}{1 - \cos x} =$ _____ .

(13) $\lim_{x\to 0} \dfrac{1 - \cos x}{3x \sin x} = \dfrac{1}{a}$ where $a =$ _____ .

(14) $\lim_{x\to 0} \dfrac{\tan 3x - \sin 3x}{x^3} = \dfrac{a}{2}$ where $a =$ ______ .

(15) $\lim_{h\to 0} \dfrac{\sin 2h}{5h^2 + 7h} =$ _________ .

(16) $\lim_{h\to 0} \dfrac{\cot 7h}{\cot 5h} =$ _________ .

(17) $\lim_{x\to 0} \dfrac{\sec x - \cos x}{3x^2} = \dfrac{1}{a}$ where $a =$ _____ .

(18) $\lim_{x\to \infty} \dfrac{(9x^8 - 6x^5 + 4)^{1/2}}{(64x^{12} + 14x^7 - 7)^{1/3}} = \dfrac{a}{4}$ where $a =$ _____ .

(19) $\lim_{x\to \infty} \sqrt{x}(\sqrt{x + 3} - \sqrt{x - 2}) = \dfrac{a}{2}$ where $a =$ _____ .

(20) $\lim_{x\to \infty} \dfrac{7 - x + 2x^2 - 3x^3 - 5x^4}{4 + 3x - x^2 + x^3 + 2x^4} = \dfrac{a}{2}$ where $a =$ ______ .

(21) $\lim_{x\to \infty} \dfrac{(2x^4 - 137)^5}{(x^2 + 429)^{10}} =$ _______ .

(22) $\lim\limits_{x\to\infty} \dfrac{(5x^{10}+32)^3}{(1-2x^6)^5} = -\dfrac{a}{32}$ where $a =$ ________ .

(23) $\lim\limits_{x\to\infty} \left(\sqrt{x^2+x} - x\right) = \dfrac{1}{a}$ where $a =$ _____ .

(24) $\lim\limits_{x\to\infty} x(256x^4 + 81x^2 + 49)^{-1/4} = \dfrac{1}{a}$ where $a =$ _____ .

(25) $\lim\limits_{x\to\infty} x\left(\sqrt{3x^2+22} - \sqrt{3x^2+4}\right) = a\sqrt{a}$ where $a =$ _____ .

(26) $\lim\limits_{x\to\infty} x^{\frac{2}{3}}\left((x+1)^{\frac{1}{3}} - x^{\frac{1}{3}}\right) = \dfrac{1}{a}$ where $a =$ _____ .

(27) $\lim\limits_{x\to\infty} \left(\sqrt{x+\sqrt{x}} - \sqrt{x-\sqrt{x}}\right) =$ _____ .

(28) Let $f(x) = \begin{cases} 2x-1, & \text{if } x < 2; \\ x^2+1, & \text{if } x > 2. \end{cases}$ Then $\lim\limits_{x\to 2^-} f(x) =$ _____ and $\lim\limits_{x\to 2^+} f(x) =$ _____ .

(29) Let $f(x) = \dfrac{|x-1|}{x-1}$. Then $\lim\limits_{x\to 1^-} f(x) =$ ______ and $\lim\limits_{x\to 1^+} f(x) =$ _____ .

(30) Let $f(x) = \begin{cases} 5x-3, & \text{if } x < 1; \\ x^2, & \text{if } x \geq 1. \end{cases}$ Then $\lim\limits_{x\to 1^-} f(x) =$ _____ and $\lim\limits_{x\to 1^+} f(x) =$ _____ .

(31) Let $f(x) = \begin{cases} 3x+2, & \text{if } x < -2; \\ x^2+3x-1, & \text{if } x \geq -2. \end{cases}$ Then $\lim\limits_{x\to -2^-} f(x) =$ ______ and $\lim\limits_{x\to -2^+} f(x) =$ ______ .

(32) Suppose $y = f(x)$ is the equation of a curve which always lies between the parabola $x^2 = y - 1$ and the hyperbola $yx + y - 1 = 0$. Then $\lim\limits_{x\to 0} f(x) =$ _____ .

Name: **Problem Set #:**

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